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1.0 Introduction

1.1 Goal

The goal is to provide information on leptospirosis and guidelines for the prevention of infection in humans.

1.2 Rationale

Leptospirosis is a zoonotic disease that has seen a possible resurgence in dogs in several areas in North America. The apparent increase in recent canine cases may be influenced by global climate change (Prescott 2002, Prescott 2008). It is therefore reasonable to consider that it may be on the rise in other domestic and wild animal populations. Furthermore, the literature suggests that leptospirosis is under diagnosed in humans because it is often mild, asymptomatic or presents with non-specific symptoms (Wong 1977, Center for Food Security and Public Health 2005).
Although no *locally acquired* human cases of leptospirosis have ever been reported to the BCCDC, the potential presence of animal cases of leptospirosis in BC suggests that local acquisition of human infection is possible.

2.0 Methodology

A web search was done looking for guidelines from other health authorities in Canada, the United States, Australia, the United Kingdom and the World Health Organization. ProMed was scanned for reports associated with exposure to companion animals. Medline was searched using the terms: "Case-Control Studies", “Case Reports”, “Leptospirosis (subheadings epidemiology, prevention and control, transmission)", and "Risk Factors". Targeted interviews were carried out with experts in the field.

3.0 Disease Identification

3.1 Clinical Description

Animals:

Clinical presentation varies with animal species. Leptospires are usually adapted to their primary hosts and cause little illness in these. An increased incidence of illness can be seen when a new serovar is introduced to a host species. Leptospirosis in dogs can be asymptomatic or range from a transient fever to an acute, fulminant illness with fever, anorexia, vomiting, mucosal injection, myositis and liver or renal failure.
Animals shed leptospires for at least 1-3 weeks and possibly for years or the lifetime of the animal.

The incubation period in animals varies with species. In dogs it is 4-12 days (Center for Food Security and Public Health 2005).

Vaccines are available for animals, but vaccination only prevents clinical symptoms, and may not prevent infection and shedding of the leptospires (Heymann 2004). Treatment of dogs with antibiotics is effective in preventing urinary shedding of leptospires (Brown 2008).

Humans:

Symptoms are usually sudden in onset and consist of fever, chills, headache, severe muscle pain, malaise and conjunctivitis. Other features can include meningitis, gastrointestinal tract symptoms and a rash. The disease is generally biphasic: a leptospiraemic or febrile stage is followed by a convalescent or immune phase. The disease can manifest as a milder, anicteric form or a more severe, icteric form (5-10% of cases). The case-fatality rate is low (1 to 5%), but may reach 20% in outbreaks of icteric disease associated with hepatorenal failure (Weil's disease) in the absence of dialysis. Asymptomatic infection also occurs. Disease severity varies with the infecting serovar. Clinical illness can last from a few days to several weeks and shedding of bacteria may persist for months and even years. Illness can be more severe in the elderly and can lead to fetal loss in pregnant women (Brown 2008, Heymann 2004).

The incubation period in humans is usually 10 days, with a range of 2-30 days.

The period of transmissibility is at its peak during infection, but prolonged excretion through the urinary tract can occur in both humans and animals (Heymann 2004).

3.2 Infectious Agent

Leptospirosis is caused by the spirochete *Leptospira interrogans*. There are over 200 pathogenic serovars, divided into 25 serogroups. Infection confers serovar-specific immunity, but further infections can occur with different serovars (Heymann 2004).

3.3 Mode of Transmission

Leptospirosis is a zoonotic infection transmitted between animals or to humans through direct contact of abraded skin or mucous membranes with an infected animal's urine, blood, amniotic fluid, tissues, or with soil, vegetation and water contaminated with infected urine.

Exposures that pose a risk of transmission also include splashes of infected material into eyes, ingestion of contaminated food or water and inhalation of aerosols of contaminated fluid (Public Health Agency of Canada 2001). Leptospires may also be able to penetrate intact skin that has been in water for a long time (Center for Food Security and Public Health 2005).

Normal interaction with an infected pet is considered a low risk for leptospirosis. Assisting with the delivery of a newborn from an infected animal may be a high-risk activity (bCenters for Disease Control and Prevention 2005, New Brunswick Health and Wellness 2002). Milking cows also poses a risk of infection from *Leptospira interrogans* serovars hardjo and pomona (Blood and Radostits 1989).

Many animals are susceptible to leptospirosis infection, including amphibians, reptiles and mammals. Some reports cite the occurrence of infection in California Sea Lions and Northern Elephant Seals (Gulland 1996, Colegrove 2005). Exposure could occur in brackish tidal pools frequented by pets and their owners along coastal areas where strandings or colonies of these animals occur. The influence of freshwater is significant since leptospires will not survive salinities greater than 1% (Gulland 1996).

Leptospires do not multiply outside the host, but under certain conditions they can survive for several weeks to months in water and moist soil. They do not survive long without moisture – they are killed by dehydration or temperature in excess of 50°C. For disinfection purposes, leptospires are inactivated by 70% ethanol, glutaraldehyde, formaldehyde, detergents and acid. They are also destroyed by moist heat, at 121°C for 15 minutes and by pasteurization (Center for Food Security and Public Health 2005).

There is some evidence that leptospires can be transmitted to infants through breast-feeding, causing infection (Center for Food Security and Public Health 2005). However, person-to-person transmission is rare (Heymann 2004).

The infectious dose of leptospires needed to initiate an infection is not known (Public Health Agency of Canada 2001) although incidents of infection acquired through primary (e.g. swimming) and secondary (e.g. kayaking) recreational water exposure suggest a low dose given the dilution factor that must be present and that leptospires do not multiply outside the host.

3.4 Reservoirs of Infection

Animal reservoirs that may pose a risk for human exposure include dogs, rats, raccoons, skunks and livestock. The occurrence of leptospirosis in cats is rare (bCenters for Disease Control and Prevention 2005).

One species may host one or more serovars, and one serovar may be found in several host species (Wong 1977). Serovars canicola and icterohaemorrhagiae are no longer the main serovars in dogs; they now include grippotyphosa and pomona (Prescott 2002). The reasons for this shift may include interaction with urban wildlife and vaccination for the previously major serovars (Public Health Agency of Canada 2001, Prescott 2002).

4.0 Epidemiological/Historical Information

Leptospirosis occurs worldwide, except in polar regions. It is considered to be the most widespread zoonosis in the world (aCenters for Disease Control and Prevention 2005).

In developing countries, leptospirosis is typically an occupational disease associated with sugarcane workers, farmers and military troops exposed to soil and water contaminated by the urine of infected wild or domestic animals. In developed countries, other occupational groups may acquire disease by direct contact with animal urine (e.g. veterinarians, workers in animal husbandry and pet shop employees). Leptospirosis has been associated with flooding and residents in inner cities where there is contact with rodent and dog urine. More recently, it has emerged as a recreational water hazard in temperate and tropical zones, particularly for adventure racers (Trevejo 1998, ProMED-mail 2004, Wong 1977, Demers 1983, Vinetz 1996, Sejvar 2003).

Worldwide, about 20% of cases of leptospirosis are thought to be associated with pets or rodents in or around the home. However, this association is rarely reported in developed countries (Leptospirosis Information Center, www.leptospirosis.org, by electronic communication 2006 Sep 23). There are few case of reports of leptospirosis transmitted from pets to humans, and it is not clear whether transmission was associated with illness in the animal (ProMED-mail 2004). A case series of children with leptospirosis implicated exposure to dogs, but the dogs were not noted to be ill (Wong 1977). A case control study has shown dog ownership and the presence of rodents to be a risk factor for leptospirosis in the context of flooding in a developing country (Trevejo 1998). One report states that before serovar canicola was controlled in dogs through vaccination, there were cases of serious illness in children in the United States (Brown 2008). Under diagnosis and under reporting of the disease is frequent, due to asymptomatic infection and the wide range of symptoms (Center for Food Security and Public Health 2005, Wong 1977, and Vinetz 1996).

A resurgence of leptospirosis in dogs reported in some areas of North America is thought to be due to exposure of pets to increased populations of urban wildlife, with a shift in prevalence of serovars from canicola and icterohaemorrhagiae to grippotyphosa and pomona (Prescott 2002).

The primary reservoirs of these two latter serovars are raccoons, opossums and skunks, with dogs, cats, humans and other animals being incidental hosts (North American Veterinary Conference 2005).

A significant source of infection for humans is the rat, which is a worldwide reservoir of serovar icterohaemorrhagiae, associated with the more serious, icteric manifestation of leptospirosis (Center for Food Security and Public Health 2005). One report indicates that 90% of the rats in Detroit are infected with *L. interrogans* serovar icterohaemorrhagiae (Demers 1983). Only a few studies have been undertaken in Canada to assess the enzooticity in rats: one study in 1926 and 1927 demonstrated a 37% prevalence in rats in Toronto and, a second study found a 4.8% prevalence in rats collected in coastal British Columbia in 1948. Another study found a mean infection rate in Norway rats (*Rattus norvegicus*) of 23% in Eastern Canada (McKiel 1961).

Parts of the world with similar climates and animal species to British Columbia have observed leptospirosis in their animal populations. For example, with regard to wildlife, one study found varying frequencies of different serovars in small wild mammals (ranging from 0.4 to 58%) and deer (4%) in Denmark (Fennestad 1972). A New Zealand survey showed a 34% seroprevalence of *Leptospira* among farmers milking cows (Blood and Radostits 1989). Further, a Washington State report cited a significant number of canine cases of leptospirosis between October 1, 2004 and June 15, 2006 (Washington State Department of Health 2006). These areas are similar to parts of British Columbia in geography and climate. Although not much information exists on the presence or prevalence of leptospirosis in animal populations in British Columbia, there is no reason to believe that it would not be similar to that observed in developed countries.

Only two human cases of leptospirosis, acquired outside BC, have been reported to the BCCDC, both in 2006.

5.0 Contact management

5.1 Precautions

The following are recommended precautions to prevent leptospirosis:

Pet exposure:

- Pet owners are encouraged to wash their hands after cleaning up indoor urine accidents from pets, washing the animal or disposing of any bedding that is contaminated with urine.
- Pet owners who may have cuts and abrasions should cover them with waterproof dressings if their pet is infected.
- Pet owners with babies or toddlers should avoid letting their children crawl or play in areas of the yard where there may be fresh urine.
- After petting or handling animals, and when licks or nips have occurred, thorough washing of hands with warm water and soap should be encouraged.
- Pet access to food preparation areas, human bedding or garden areas where food is being grown should be discouraged, to avoid contamination.
- When cleaning surfaces that may be contaminated or have urine from an infected pet on them, owners should use an antibacterial cleaning solution, detergent or a solution of 1 part household bleach in 10 parts water (bCenters for Disease Control and Prevention 2005).
- Dog owners should discuss vaccination of their pet with their veterinarian.
- Pet owners should be discouraged from leaving food and water outside where it can attract wildlife. It would be prudent for pregnant or breast-feeding women, the elderly and young children to avoid cleaning up animal wastes and contact with sick animals during periods of peak transmissibility (up to 3 weeks after onset of infection), if possible.

Occupational exposure:

- Farmers should prevent contact of livestock with rodents, wild animals and other livestock, which could potentially be infected.
- The living quarters of infected livestock should be cleaned, disinfected and dried before exposing healthy animals to those areas.
- Farmers should discuss the possibility of vaccination and antibiotic use with their veterinarian to prevent and minimize outbreaks in their livestock.
- Farmers should minimize exposure of livestock to contaminated water by avoiding urine drainage into water sources and draining swampy land (Editorial Journal of Veterinary Medicine Association).

- People working in animal husbandry should consider wearing appropriate personal protective equipment such as gloves and boots when touching animals or working in stalls and stables, and especially if there are any symptoms of infection among the animals (bCenters for Disease Control and Prevention 2005).
- Veterinarians may want to consider pre- or post-exposure prophylaxis if they will be working with infected animals or if they have determined that an exposure to infected fluids or tissue has occurred (see section 5.3).
- Pet shop owners should wear rubber gloves when cleaning up animal waste, especially that of dogs, and especially that of any animal that appears ill. Thorough hand washing after clean-up is encouraged.

Recreational exposure:

- Eco and adventure tourists should be made aware of the risks and take appropriate measures to protect exposed skin (regardless of whether or not it is intact), eyes and mucous membranes as much as possible during primary and secondary contact with recreational water in tropical areas.
- Eco adventure tourists and others should discuss pre-exposure prophylaxis (see section 5.3) with their health care provider or a travel clinic if they will be participating in high-risk activities.
- The public should avoid swimming and boating in bodies of freshwater that could be influenced by recent heavy rains or flooding and that could receive drainage from agricultural areas.

5.2 Testing humans

In the event of symptoms in human contacts, infection can be assessed through the ELISA technique for initial screening, and a paired microscopic agglutination test (MAT) using a panel of locally available serovars. Diagnosis is confirmed by seroconversion or a 4-fold or greater rise in titre from samples collected ≥ 2 weeks apart. During acute illness, diagnosis can be done by culture or dark field microscopy of leptospires in blood (first 7 days), cerebrospinal fluid (CSF) (days 4-10) or urine (after day 10). (Heymann 2004). All specimens should be sent to BCCDC. Actual testing is conducted at the National Microbiology Laboratory in Winnipeg.

5.3 Prophylaxis and treatment of human contacts

There is no commercially available vaccine for humans.

Pre-exposure prophylaxis may be beneficial for people who will be experiencing exposures that carry a high risk of infection. These include soldiers training in tropical regions, adventure tourists who will have freshwater exposure (especially tropical) and veterinarians who will be working with infected animals. Doxycycline at 200mg once for a single exposure or once a week throughout ongoing exposure is recommended (Brown 2008, Guidugli 2000, Heymann 2004).

Antibiotic post-exposure prophylaxis (e.g. doxycycline at 200 mg) is indicated for persons who have been exposed to leptospires. However, antibiotic prophylaxis is not routinely offered to protect owners of animals which have been infected with leptospirosis as the risk of transmission through normal human contact with animals is considered low (e.g. if there is no physical contact with the animal's urine) (Brown 2008, Heymann 2004).

Doxycycline prophylaxis is contra-indicated in pregnant or breast-feeding women and children under the age of 8. As indicated, it may be prudent for these individuals to avoid clean-up of animal wastes and contact with pets during peak periods of transmission (1-3 weeks after onset).

Prompt antibiotic treatment of human cases can reduce the duration of fever, but may not reduce mortality. Penicillin is the drug of choice, but alternatives are doxycycline, ampicillin, erythromycin, cephalosporins and quinalone antibiotics (Heymann 2004).

6.0 Authority

Human infection is reportable to public health authorities under section 2 of the Communicable Disease Regulation (leptospirosis is found in schedule B of the list of reportable diseases), pursuant to the BC Health Act (RSBC 1996).

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